



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/715,227	11/17/2003	Zhiping Yin	3657.5US (98-0265.05/US)	5021
63162 7590 04/07/2008 TRASK BRITT, P.C./ MICRON TECHNOLOGY P.O. BOX 2550 SALT LAKE CITY, UT 84110				
EXAMINER				
LEWIS, MONICA				
ART UNIT		PAPER NUMBER		
2822				
NOTIFICATION DATE		DELIVERY MODE		
04/07/2008		ELECTRONIC		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USPTOMail@traskbritt.com

### Office Action Summary

**Application No.**

10/715,227

**Applicant(s)**

YIN, ZHIPING

**Examiner**

MONICA LEWIS

**Art Unit**

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 February 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-12 and 14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

1. This Office action is in response to the request for continued examination filed February 19, 2008.

***Continued Examination Under 37 CFR 1.114***

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/19/08 has been entered.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Prior Art.

In regards to claim 1, Applicant's Prior Art discloses the following:

- a) a first layer (42) comprising anti-reflective material (For Example: See Figure 4);
- b) a second layer (46) comprising silicon nitride, located over the first layer, and including in-film particles (44) (For Example: See Figure 4); and

c) substantially free of in-film particles or surface roughness of about 120 nm to about 150 nm (For Example: See Paragraph 9 and 36) (Note: Although the specification does not specifically disclose the limitation above, Applicant disclosed in the response that "semiconductor devices that have an imperfection density of less than about 40,000 particles of about 120-150 nm dimension per eight inch diameter...result is a maximum imperfection density of 1.27, or about  $1 \frac{1}{4}$ , particles or surface roughness features per square millimeter." The prior art discloses that in-film particles have a size of about 120-150 nm and a density on the semiconductor device structure 40 of about 40,000 or more per eight-inch diameter wafer. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm i.e., 100 Angstroms." The court stated that "by stating that suitable protection is provided if the protective layer is about 100 Angstroms thick, the prior art reference directly teaches the use of a thickness within applicant's claimed range."). Similarly, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. Titanium Metals Corp. of America v. Banner, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985)).

In regards to claims 2 and 9, Applicant's Prior Art discloses the following:

a) the anti-reflective material comprises silicon atoms and nitrogen atoms  
(For Example: See Paragraph 36).

In regards to claims 3 and 10, Applicant's Prior Art discloses the following:

a) the anti-reflective material further comprises oxygen atoms (For Example: See Paragraph 36).

In regards to claims 4 and 11, Applicant's Prior Art fails to disclose the following:

a) the anti-reflective material comprises  $\text{Si}_x\text{O}_y\text{N}_z$  where x equals about 0.40 to about 0.65 times the sum of x, y, and z, y equals about 0.02 to about 0.56 times the sum of x, y, and z, and z equals about 0.05 to about 0.33 times the sum of x, y, and z.

However, the applicant has not established the critical nature of "the anti-reflective material comprises  $\text{Si}_x\text{O}_y\text{N}_z$  where x equals about 0.40 to about 0.65 times the sum of x, y, and z,

y equals about 0.02 to about 0.56 times the sum of x, y, and z, and z equals about 0.05 to about 0.33 times the sum of x, y, and z.” “The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range.” *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claims 5 and 12, Applicant's Prior Art discloses the following:

a) a surface of said the first layer is substantially free of at least one of measurable particulates and surface roughness (For Example: See Figure 4).

In regards to claim 6, Applicant's Prior Art discloses the following:

a) the second layer is substantially free of at least one of particles and surface roughness features of at least about 120 nm (For Example: See Paragraph 9 and 36) (Note: Although the specification does not specifically disclose the limitation above, Applicant disclosed in the response that “semiconductor devices that have an imperfection density of less than about 40,000 particles of about 120-150 nm dimension per eight inch diameter...result is a maximum imperfection density of 1.27, or about  $1\frac{1}{4}$ , particles or surface roughness features per square millimeter.” The prior art discloses that in-film particles have a size of about 120-150 nm and a density on the semiconductor device structure 40 of about 40,000 or more per eight-inch diameter wafer. In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of “about 1-5%” while the claim was limited to “more than 5%.” The court held that “about 1-5%” allowed for concentrations slightly above 5% thus the ranges overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of “50 to 100 Angstroms” considered prima facie obvious in view of prior art reference teaching that “for suitable protection, the thickness of the protective layer should be not less than about 10 nm i.e., 100 Angstroms.” The court stated that “by stating that suitable protection” is provided if the protective layer is about 100 Angstroms thick, the prior art reference directly teaches the use of a thickness within applicant's claimed range.”). Similarly, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one

Art Unit: 2822

skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985)).

In regards to claims 7 and 14, Applicant's Prior Art discloses the following:

a) the second layer is formed on the first layer (For Example: See Figure 4).

In regards to claim 8, Applicant's Prior Art discloses the following:

a) a first layer comprising anti-reflective material (For Example: See Figure 4);

b) a second layer comprising silicon nitride, located over the first layer, and including in-film particles (For Example: See Figure 4); and

c) substantially free of particles or surface roughness features of at least 120 nanometers (For Example: See Paragraph 9 and 36) (Note: Although the specification does not specifically disclose the limitation above, Applicant disclosed in the response that "semiconductor devices that have an imperfection density of less than about 40,000 particles of about 120-150 nm dimension per eight inch diameter...result is a maximum imperfection density of 1.27, or about  $1\frac{1}{4}$ , particles or surface roughness features per square millimeter." The prior art discloses that in-film particles have a size of about 120-150 nm and a density on the semiconductor device structure 40 of about 40,000 or more per eight-inch diameter wafer. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm i.e., 100 Angstroms." The court stated that "by stating that suitable protection' is provided if the protective layer is about' 100 Angstroms thick, the prior art reference directly teaches the use of a thickness within applicant's claimed range."). Similarly, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985)).

5. Claims 1-12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Prior Art in view of *Performance of a Vertical LPCVD Apparatus* by Ogawa et al.

In regards to claim 1, Applicant's Prior Art discloses the following:

a) a first layer (42) comprising anti-reflective material (For Example: See Figure 4); and

b) a second layer (46) comprising silicon nitride, located over the first layer, and including in-film particles (44) (For Example: See Figure 4).

In regards to claim 1, Applicant's Prior Art fails to disclose the following:

a) substantially free of in-film particles or surface roughness features of about 120 nm to about 150 nm.

However, Ogawa et al. ("Ogawa") discloses a layer that is substantially free of in-film particles or surface roughness of 120 nm to about 150 nm (For Example: See Abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Applicant's Prior Art to include a layer that is substantially free of in-film particles or surface roughness of 120 nm to about 150 nm as disclosed in Ogawa because it aids in reducing particle defects (For Example: See Page 1103).

Additionally, since Applicant's Prior Art and Ogawa are both from the same field of endeavor, the purpose disclosed by Ogawa would have been recognized in the pertinent art of Applicant's Prior Art.

In regards to claims 2 and 9, Applicant's Prior Art discloses the following:

a) the anti-reflective material comprises silicon atoms and nitrogen atoms (For Example: See Paragraph 36).

In regards to claims 3 and 10, Applicant's Prior Art discloses the following:

a) the anti-reflective material further comprises oxygen atoms (For Example: See Paragraph 36).

In regards to claims 4 and 11, Applicant's Prior Art fails to disclose the following:

a) the anti-reflective material comprises  $\text{Si}_x\text{O}_y\text{N}_z$  where x equals about 0.40 to about 0.65 times the sum of x, y, and z, y equals about 0.02 to about 0.56 times the sum of x, y, and z, and z equals about 0.05 to about 0.33 times the sum of x, y, and z.

However, the applicant has not established the critical nature of "the anti-reflective material comprises  $\text{Si}_x\text{O}_y\text{N}_z$  where x equals about 0.40 to about 0.65 times the sum of x, y, and z, y equals about 0.02 to about 0.56 times the sum of x, y, and z, and z equals about 0.05 to about 0.33 times the sum of x, y, and z." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claims 5 and 12, Applicant's Prior Art discloses the following:

a) a surface of said the first layer is substantially free of at least one of measurable particulates and surface roughness (For Example: See Figure 4).

In regards to claim 6, Applicant's Prior Art fails to disclose the following:

a) the second layer is substantially free of at least one of particles and surface roughness features of at least about 120 nm.

However, Ogawa discloses a layer that is substantially free of at least one of particles and surface roughness features of at least about 120 nm (For Example: See Abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Applicant's Prior Art to include a layer that is substantially free of



at least one of particles and surface roughness features of at least about 120 nm as disclosed in Ogawa because it aids in reducing particle defects (For Example: See Page 1103).

Additionally, since Applicant's Prior Art and Ogawa are both from the same field of endeavor, the purpose disclosed by Ogawa would have been recognized in the pertinent art of Applicant's Prior Art.

In regards to claims 7 and 14, Applicant's Prior Art discloses the following:

a) the second layer is formed on the first layer (For Example: See Figure 4).

In regards to claim 8, Applicant's Prior Art discloses the following:

a) a first layer comprising anti-reflective material (For Example: See Figure 4); and

b) a second layer comprising silicon nitride, located over the first layer, and including in-film particles (For Example: See Figure 4).

In regards to claim 8, Applicant's Prior Art fails to disclose the following:

a) substantially free of in-film particles or surface roughness features of at least about 120 nanometers.

However, Ogawa discloses a layer that is substantially free of in-film particles or surface roughness features of at least about 120 nanometers (For Example: See Abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Applicant's Prior Art to include a layer that is substantially free of in-film particles or surface roughness features of at least about 120 nanometers as disclosed in Ogawa because it aids in reducing particle defects (For Example: See Page 1103).

Additionally, since Applicant's Prior Art and Ogawa are both from the same field of endeavor, the purpose disclosed by Ogawa would have been recognized in the pertinent art of Applicant's Prior Art.

***Response to Arguments***

6. Applicant's arguments filed 2/19/08 have been fully considered but they are not persuasive. First, Applicant argued that "the mere discussion of semiconductor device structures with silicon nitride layers including non-uniformities or particles of about 120-150 nm dimension...at an incidence of about 40,000 or more per eight inch diameter wafer...in the BACKGROUND section does not qualify that background section" as prior art...even if the phrase substantially free were defined to include a per area average of less than about 40,000 non-uniformities or particles per eight inch semiconductor wafer, it is respectfully submitted that less than about 40,000 does not overlap about 40,000 or more." Applicant disclosed in the response (12/16/04) that "semiconductor devices that have an imperfection density of less than about 40,000 particles of about 120-150 nm dimension per eight inch diameter...result is a maximum imperfection density of 1.27, or about  $1\frac{1}{4}$ , particles or surface roughness features per square millimeter." The prior art discloses that in-film particles have a size of about 120-150 nm and a density on the semiconductor device structure 40 of about 40,000 or more per eight inch diameter wafer. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus

the ranges overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm i.e., 100 Angstroms." The court stated that "by stating that suitable protection' is provided if the protective layer is about' 100 Angstroms thick, the prior art reference directly teaches the use of a thickness within applicant's claimed range."'). Similarly, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. Titanium Metals Corp. of America v. Banner, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985).

Second, Applicant argued that the "Ogawa teaches processes by which dust particle contamination may be reduced, the disclosure of Ogawa is limited to quantification of dust particles having diameters of larger than 0.2  $\mu\text{m}$  or larger than 200 nm...Ogawa includes no teaching or suggestion that a semiconductor device structure may include a layer that comprises silicon nitride and that is substantially free of in-film particles or surface roughness features of at least 120 nm...or of more than 150 nm." However, Ogawa discloses that "the number of particles per square centimeter for particles larger than .2  $\mu\text{m}$  was less than ca. 1/6 of that obtained using a conventional horizontal LPCVD apparatus, when  $\text{Si}_3\text{N}_4$  was deposited" (For Example: See Abstract). Therefore, Ogawa does disclose a semiconductor device structure may include a layer that comprises silicon nitride and that is substantially free of in-film particles or surface roughness features of at least 120 nm...or of more than 150 nm.

Finally, Applicant argues that prior art does not teach or suggest that the surface of a layer that comprises anti-reflective material may be substantially free of at least one of measurable particulates or surface roughness...Fig. 4 of the above referenced application shows a large number of in-film particles 44 on the surface of dielectric anti-reflective coating ("DARC" film 42)...the above referenced application explains that the presence of about 40,000 or more non-uniformities or particles in a silicon nitride layer." Merriam-Webster defines "substantially" as being largely but not wholly that which is specified. Although the prior art discloses in-film particles (44) on film 42, it appears from figure 4 that the first layer is "substantially" free of at least one of measurable particulates or surface roughness."

#### ***Conclusion***

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MONICA LEWIS whose telephone number is 571-272-1838. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300 for regular and after final communications.

/Monica Lewis/  
Primary Examiner, Art Unit 2822

April 4, 2008